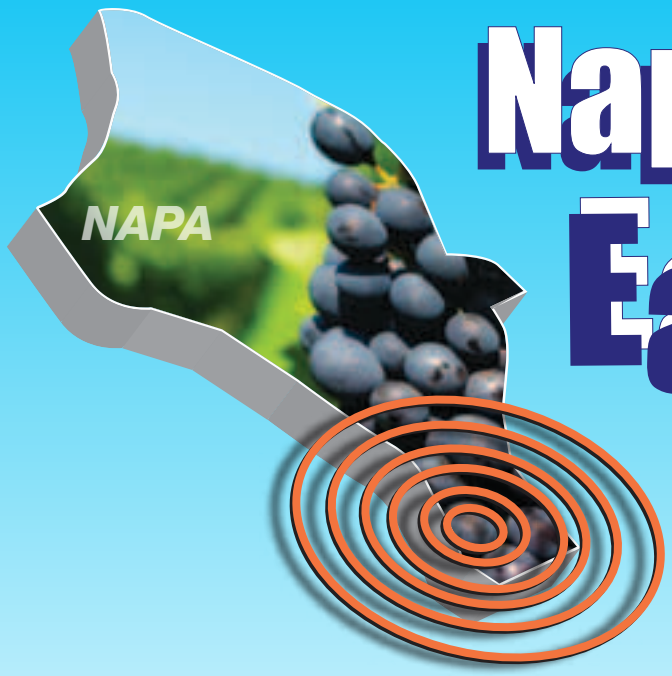


Napa Earthquake

A Snapshot of Caltrans' Emergency Response

3:20 a.m. Sunday, August 24, 2014, magnitude 6.0 earthquake

Governor's Office of Emergency Services issues an alert to all state and local agencies.

3:31 a.m.: Caltrans receives ShakeCast notifications, which are expected about 10 minutes after a seismic event.

3:38 a.m.: Traffic Management Center begins phone calls to mobilize first responders.

5 a.m.: Caltrans staff are in place at the Office of Emergency Services Operations Center in Sacramento.

5 a.m.: State Operations Center gathers reports from the California Highway Patrol.

ShakeCast: A Valuable Tool in Caltrans' Earthquake Response

ShakeCast is a real-time alert that provides first responders with notifications and information immediately following earthquakes and helps direct and prioritize emergency bridge and building inspections. ShakeCast, developed through Caltrans research with the U.S. Geological Survey, uses a combination of ShakeMaps and Caltrans bridge data to identify the bridges most likely to have sustained damage in the stronger shaking zones. Caltrans has used the ShakeCast/ShakeMap systems, available through the USGS, since 2008. ShakeMaps plot the regional distribution of strong ground shaking based on data from thousands of seismic sensors statewide.

This was the first time Caltrans used ShakeCast to identify and inspect quake-damaged transportation-related buildings. Because this feature of the system was still in test mode, email notifications about the buildings were not sent out to Caltrans first responders, as they were for the bridges, but information gleaned from the monitors was shared with local building inspectors in the weeks that followed.

CISN ShakeMap: 6.7 km (4.2mi) NW of American Canyon, CA.
Aug 24, 2014 10:20:44 AM UTC M5.7 N38.21 W122.31 Depth: 10.8km ID:72282711

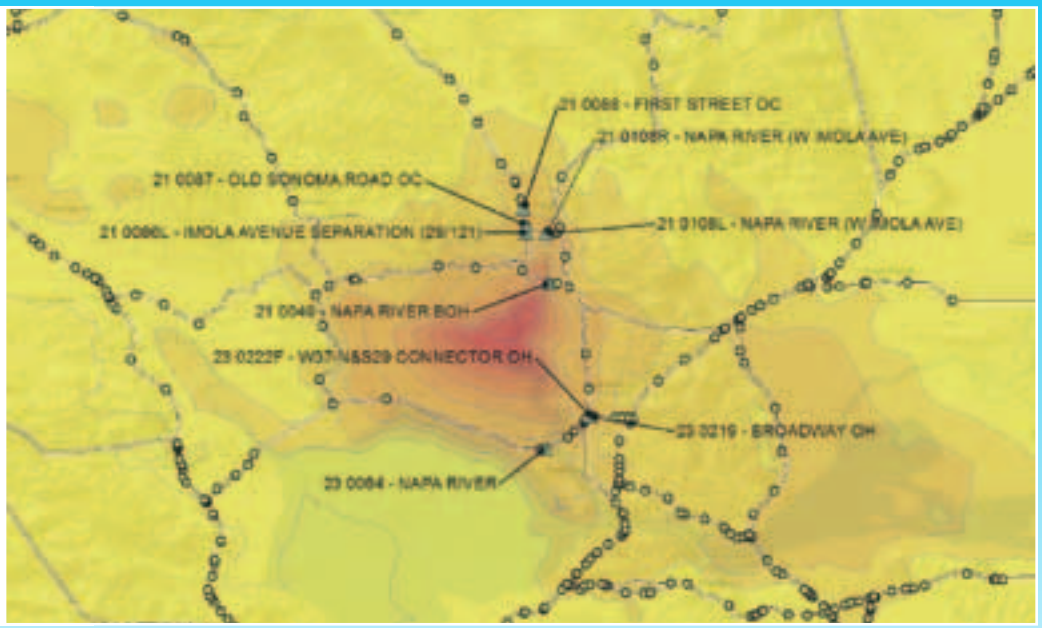
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.1	0.5	2.4	6.7	13	24	44	83	>156
PEAK VEL.(cm/s)	<0.07	0.4	1.9	5.8	11	22	43	83	>160
INSTRUMENTAL INTENSITY	I	II–III	IV	V	VI	VII	VIII	IX	X+

The epicenter of the Napa Earthquake is marked with a star in the image above. The yellow area shows the spread of the shaking. Note that Vallejo was in an area where people would feel a powerful jolt, but where significant damage would be unlikely. Caltrans uses such data to determine which highway structures need to be inspected, and in what order.

Map Legend

- Green Circles – locations of state bridges on the state highway system.
- Green Triangles – locations of state bridges where damage was observed during initial inspections. Labels show the state bridge number (e.g. 21 0087) and the bridge name.

Circles in the image right represent bridges on the state highway system, and triangles represent bridges that showed some damage during the initial inspections. Powerful shaking, shown as darker shades of yellow and orange, were concentrated away from the highway system.



—largest seismic event in the Bay Area since 1989's Loma Prieta.

6 a.m.: Caltrans activates an Emergency Department Operations Center in its Sacramento headquarters building. Review of initial assessments begins.

7 a.m.: Caltrans activates an Emergency Operations Center in District 4, in which the quake occurred. Local personnel continue assessments and coordinate in-field activities.

2 p.m.: District 4 Emergency Operations Center completes damage assessment and provides resource needs to address repairs and further inspections. Ongoing communication is turned over to the District 4 Traffic Management Center and Maintenance management.

4 p.m.: Department Operations Center deactivated.

Assessing the Damage

Immediately after the earthquake, our Bay Area maintenance crews began checking the state highway system to make sure roads and bridges could be safely driven. Our bridge engineers checked state highway bridges in Napa County for damage during the first 48 hours after the earthquake. In all our inspectors completed emergency inspections of 47 state-owned bridges in Napa, Solano, and Contra Costa counties. This included structures on State Routes 37, 29, 121, and 221 in Napa County, Route 37 in Solano County, and Route 4 in Contra Costa County. Inspectors found cracked and flaked concrete, minor settlement and evidence of movement in some abutments, but the damage was considered minor, and all structures remained open to the public. In the following months nine emergency contracts totaling $6 million, mostly to repair bridge damage, were completed on 11 state-owned bridges on Routes 29, 37, and 121 in Napa and Solano Counties.

Our bridge engineers also inspected all seven state-owned Bay Area toll bridges and found no damage on any of those structures. At the request of Napa County, our engineers also inspected all 104 locally owned bridges in the county, and one of those bridges was closed due to damage caused by the earthquake.

Partnering with Our Local Agencies

The August 24 earthquake showed the importance of coordination and cooperation among government agencies. Cities and counties often do not have the number of trained staff they need to assess damage after a severe earthquake, such as the one that struck Napa County.

The Safety Assessment Program, run by the Governor's Office of Emergency Services, draws upon the expertise of professional engineers, architects, and certified building inspectors to help local governments evaluate building safety after a disaster. Caltrans engineers working under the state's Safety Assessment Program inspected buildings in the city. Eight of our inspectors were deployed to Vallejo in Contra Costa County to help the city inspect more than 40,000 buildings for damage. The teams inspected everything from the city's sprawling wastewater treatment plant to a local police station.

Caltrans also worked closely with the California Highway Patrol and local and regional transportation agencies to make sure transportation systems remained open. Our maintenance staff worked with the Governor's Office of Emergency Services to provide the California Earthquake Clearinghouse with office space, computers, and phones at our Napa Maintenance Station. We also worked closely with the region to provide help and support as they dealt with the aftermath of the earthquake, and to identify damage locations eligible for federal highway emergency funding.

Seismic Retrofit Program

Caltrans started its first bridge *seismic safety retrofit* program in 1971 after the San Fernando earthquake damaged several bridges. The initial seismic program was completed in 1989. That same year, the Loma Prieta earthquake in the San Francisco Bay region caused catastrophic bridge failures. In response, we established our nearly completed seismic retrofit program. After the Loma Prieta earthquake, we identified 1,039 state owned bridges as needing seismic retrofit,

Lowell Duncan of the Caltrans Napa Maintenance Crew chips loose concrete from the Maxwell Bridge on Highway 121 in Napa following the August 24, 2014, earthquake. The cowboy-style hard hat he is wearing is one of two Caltrans-authorized hard hat designs, with the other being the standard style. Caltrans provides only standard-style hard hats. Employees who wish to wear the authorized western cowboy hard hats must purchase their own.

and after the 1994 Northridge earthquake in the Los Angeles area, we identified an additional 1,155 bridges that were added to the program. The nine state-owned toll bridges were also strengthened as part of the state retrofit program.

Of the more than 2,100 bridges identified as needing seismic strengthening, all but one, the Shuyler Heim Bridge in Long Beach, have been completed. Seismic safety will be achieved at Shuyler Heim when traffic is switched off the old bridge this summer onto the first stage of the newly constructed bridge.

Seismic design innovations continue to drive the bridge program as we continually reassess our design methods to incorporate what we learn from past earthquakes and from advancements in seismic and structural engineering. We design our bridges to meet or exceed a "No Collapse" performance objective when subjected to ground shaking intensities expected to be generated by an earthquake with a 1000-year reoccurrence interval. While collapse is unlikely, significant damage is anticipated at bridges located near the earthquake epicenter. In fact, many bridges will likely need to be replaced after a large event. Select bridges, determined to be essential for emergency response, have been designed or retrofitted to a higher standard than "No Collapse." These bridges are expected to be serviceable or immediately repairable following a large earthquake.

Caltrans has long been acknowledged as a leader in seismic preparedness, an expertise born of necessity and honed through experience. Government agencies around the world routinely seek guidance on seismic design and retrofitting. Our engineers regularly share their knowledge through seminars and consultations. They also learn from the experience of their peers in other countries facing the same challenges. Applying the latest advancements in seismic science is a process that will never end.

Source: Caltrans District 4 and the Divisions of Traffic Operations, Maintenance, Construction, Engineering Services, and Research, Innovation, and System Information

The Napa earthquake loosened some of the concrete from the abutment at the Maxwell Bridge on Highway 121 in Napa. Walter Cesario of the Caltrans Napa Maintenance Crew removes a large piece of concrete from the damaged bridge.